Consideration of Decentralized Wastewater Management

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For the

Brewster Ponds Coalition

INTRODUCTION

- Thanks to the Town of Brewster, Lombardo Associates and Natural Systems Utilities for providing technical information, plans and photographs used in, or supporting this presentation. The use of such information is not an endorsement of any policies, professional practice or technologies.

WASTEWATER TREATMENT SYSTEMS

INDIVIDUAL - DECENTRALIZED – CENTRALIZED???

WHAT IS DECENTRALIZED TREATMENT

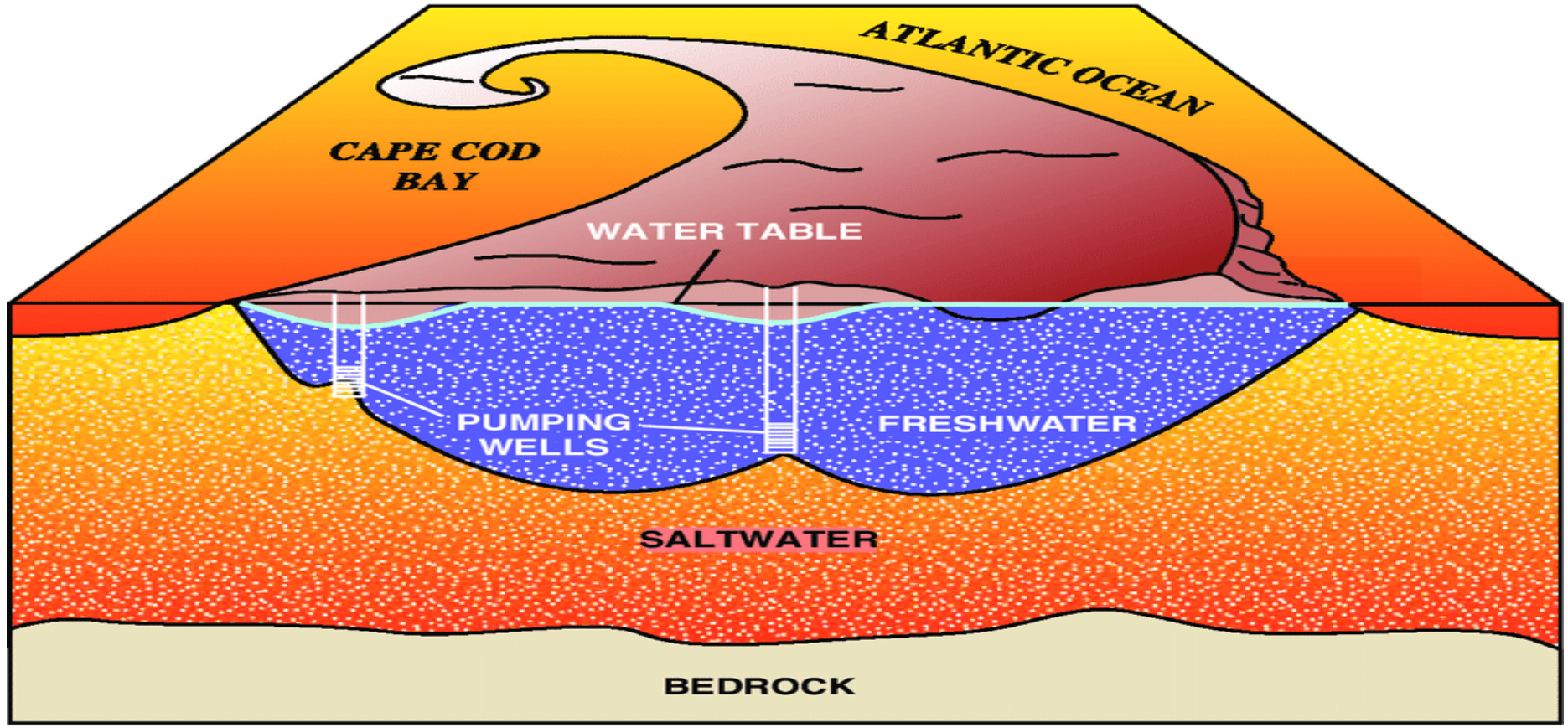
“Decentralized Systems” have become a commonly-used term to describe a wastewater treatment systems that treat and disperses wastewater from targeted area of medium to high density at or near the source of the wastewater generation. They generally range in size from 2,000 gpd to 30,000 gpd and provide advanced secondary or tertiary treatment.

Systems may serve a cluster of homes, a subdivision or small community as well as commercial and industrial complexes. If multiple sources are served, a collection system may be included to receive and convey the wastewater to a combined treatment and dispersal component. The use of decentralized treatment systems in wastewater management has been termed “wastewater redistribution” as targeting sources of wastewater generation and treated wastewater disposal to address environmental issues related to sensitive drinking water, surface water and estuary quality wherein advanced treatment is afforded.

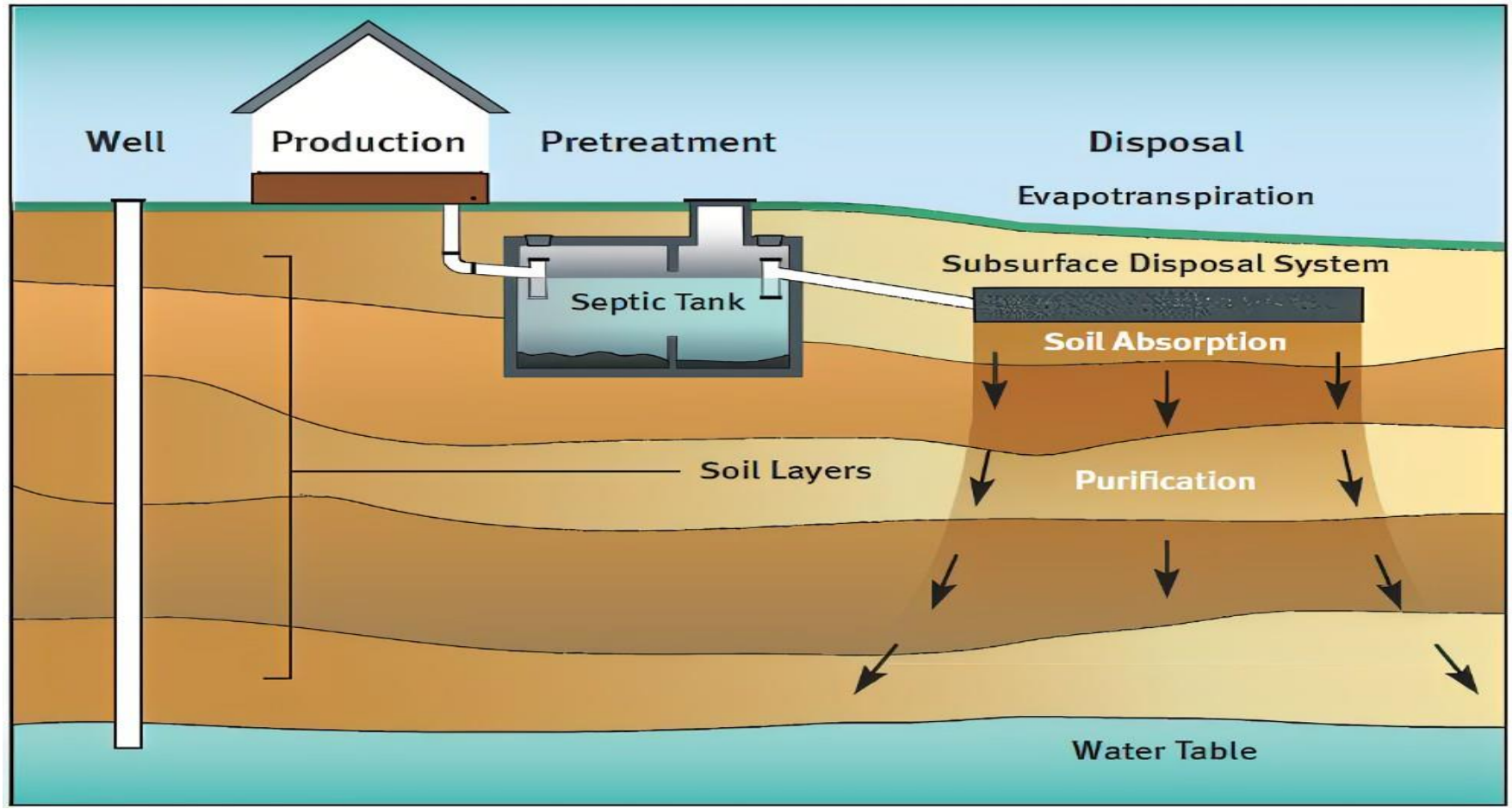
ADVANCED TREATMENT FOR REMOVAL OF POLLUTANTS

By definition, onsite wastewater management systems are a ‘green technology’ because treated effluent recharges local aquifers. A new innovation in decentralized wastewater management is the reuse or recycling of treated effluent. With appropriate safeguards, local regulations or bylaws may allow the treated water to be used for irrigation, toilet and urinal flushing or make-up water for commercial boilers. These applications reduce the demand for potable water and aid in the protection and preservation of the available water sources.

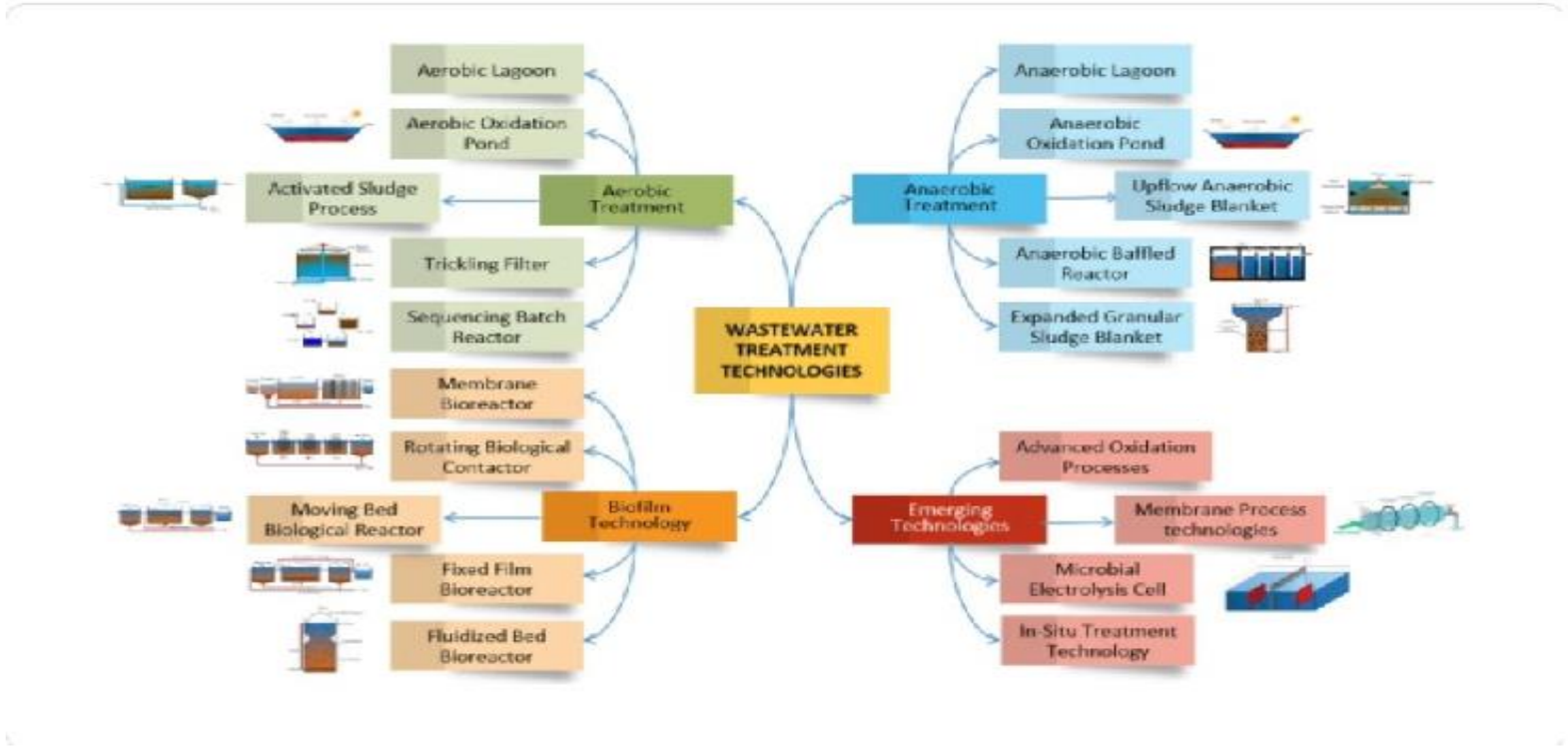
As society demands more efficient use of financial resources and sustainable environmental wastewater management, the use of managed decentralized wastewater treatment systems is a key support structure for wastewater reuse; especially wherein the Cape is a “sole source aquifer”. This requires a distributed management system with advanced secondary and tertiary treatment capacity supported by trained professional service and maintenance providers.



Schematic diagram, not to scale


Well
Production
Pretreatment
Disposal
Evapotranspiration
Subsurface Disposal System
Septic Tank
Soil Absorption
Soil Layers
Purification
Water Table

WASTEWATER TREATMENT ALTERNATIVES



MA WATER REUSE STANDARDS: CLASS A

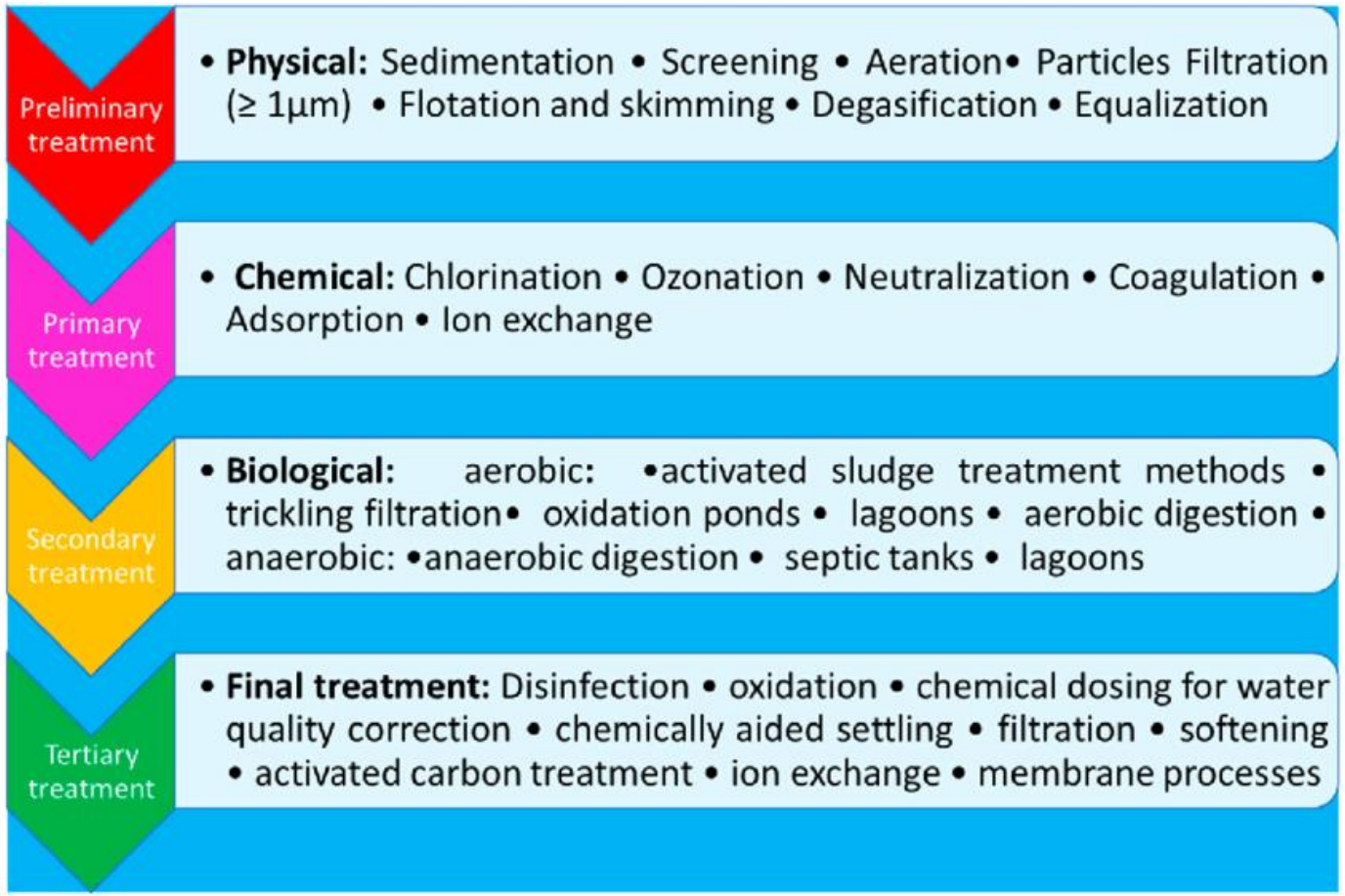
discharge.

Effluent Limits

pH = 6.5-8.5 BOD < 10 mg/l TSS < 5 mg/l Turbidity < average of 2 NTU within a 24-hour period, cannot exceed five NTU more than 5% of the time within a 24-hour period, and cannot exceed ten NTU at any time. Total Nitrogen < 10 mg/l Median of no detectable fecal coliform/100 ml over continuous seven-day sampling periods, not to exceed 14/100 ml in any one sample Other parameters as specified by the Department

On a case-by-case basis, the Department may establish a limit on phosphorus and/or establish a limit on total nitrogen that is more stringent than ten mg/l in order to maintain or achieve compliance with the Massachusetts Surface Water Quality Standards and/or to protect the actual or potential use of the ground water as a source of potable water. On a case-by-case basis, the Department may establish a limit on total nitrogen that is less stringent than ten mg/l, if the use of the reclaimed water does not involve a discharge to the ground surface or the ground water or in circumstances such as irrigation where the nutrient value of the reclaimed water is proposed to be used and the reclaimed water meets the effluent limit of ten mg/ l before it is to discharged to a water of the Commonwealth.

HIEARCHY OF WASTWATER TREATMENT



SECONDARY TREATMENT

Stage II Primary and/or Secondary Treatment: Many options are available for second stage treatment. These options can be grouped into following three categories.

a) Pond Based Systems or
b) Activated Sludge Process (ASP) and its Modifications or equivalent systems including but not limited to SBR, UASB followed by ASP, ASP operated on Extended Aeration mode (EA-ASP), ASP with Biological Nutrient Removal (ASP+BNR), and MBBR or
c) Membrane Bio Reactor (MBR)

Expected effluent quality after primary and secondary treatment:

- BOD < 30 mg/L
- SS < 20 mg/L
- Nitrified effluent

TERTIARY TREATMENT

Stage III Tertiary Treatment: Coagulation-flocculation-settling followed by filtration and disinfection is generally recommended. Other processes could be selected on the basis of land availability, cost considerations, O&M cost, reuse option, compatibility issues in case of up-gradation of existing plants, etc. However, disinfection operation should invariable be included. Expected effluent quality after tertiary treatment:

- BOD < 10 mg/L
- SS < 5 mg/L
- Phosphate < 0.5 mg/L
- MPN of fecal coliforms < 10/ 100 mL

Total Nitrogen < 10 mg/L

HIEARCHY OF TREATMENT COST

Table 3. Summary Cost Information for Alternatives

Alternative	Total Cost (Present Value)	Capital Cost	Cost ($/lb/year)
Fertilizer Reduction at Golf Courses	*$0 (savings)*	Saves $4.6-5.8 M	*$0*
Fertilizer Reduction Bylaw	*$0 (savings)*	Saves $0.8 – 1.2 M	*$0*
Alternative systems	$11.6 – 15 M	$5.2 – 8.3 M	$350 – 450
Alternative toilets	$1.7 – 6.3 M	$1.3 – 4.9 M	$50 – 190
Connection to Orleans WWTF	$5 – 11.7 M	$2.8 – 9.6 M	$150 –350
Purchase of sewer connections in Orleans	$9.5M	$8.4M	$280
Cluster/ Neighborhood treatment systems	$8.6 – 9.6 M	$4.4 – 6 M	$285-315
Irrigation wells to capture N and return it to beneficial use	*$0 (savings)*	Saves $0.9 – 2.2 M	*$0*
PRB to treat groundwater*	$8.3 –13.1M	$3.9 – 7.5M	$180 – 250
Shellfish propagation	$1.2 – 2 M	$120 – 195,000	$20-60

* Cost estimates for PRBs are based on cost information from the alternative nitrogen management matrix developed Cape Cod Commission's Section 208 team. The estimates may need to be revised once additional becomes available from Falmouth or other locations.

EXISTING ADVANCED WASTEWATER TREATMENT FACILITIES BREWSTER (Tertiary)

Ocean Edge Resort (13,040 gpd)

Pleasant Bay Nursing and Woodlands (26,500 gpd)*

Serenity (32,000 gpd)

Kings Landing (23,858 gpd)

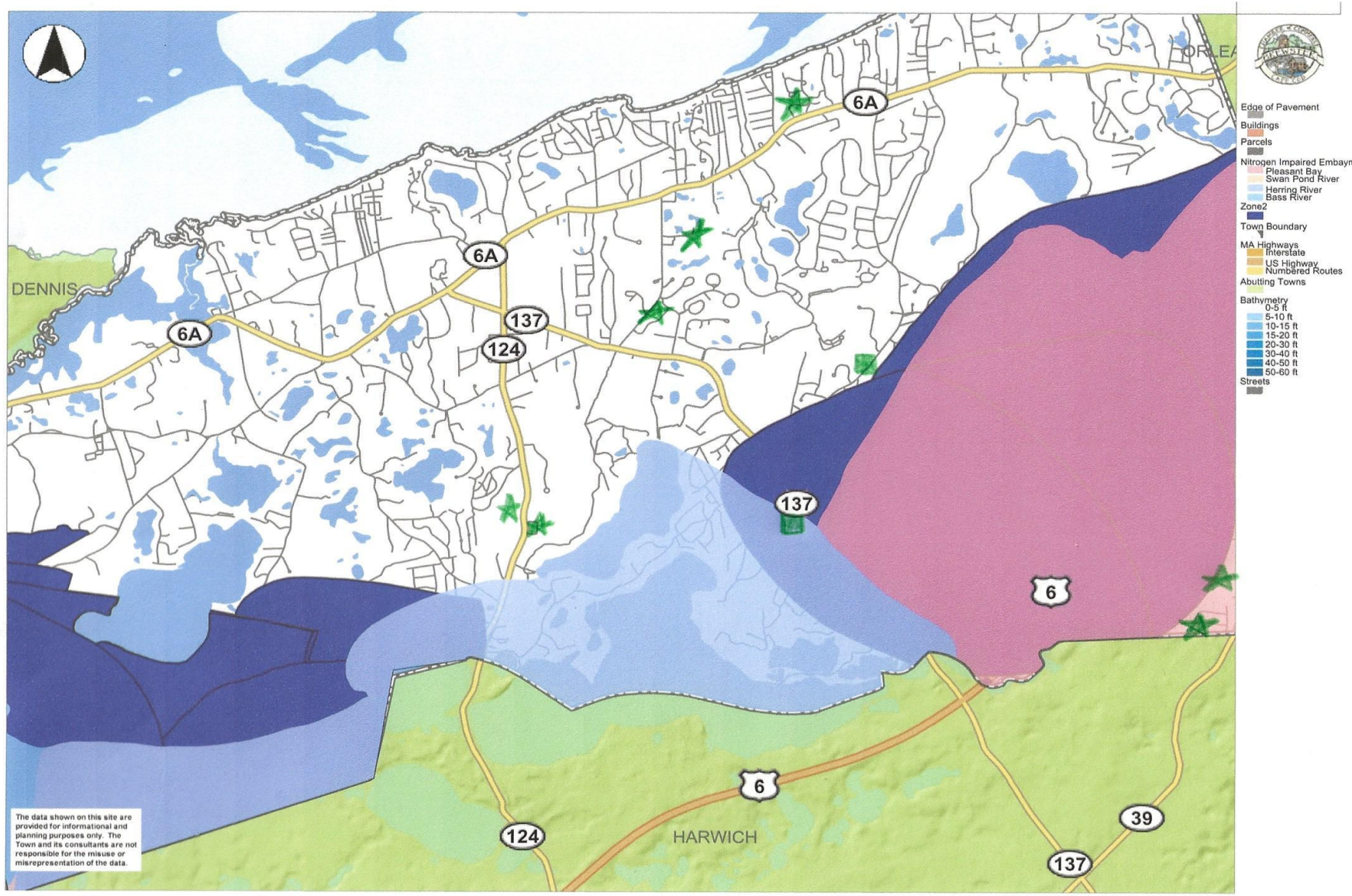
Maplewood (19,800 gpd)

White Rock Common (3,960 gpd)*

Brewster Landing (8,360 gpd)

*NITROGEN REDUCTION IN PLEASANT BAY WASTERSHED 2,300 LBS/YR

(ESTIMATED AT 75% TN REMOVAL 30,460 GPD : 35-10 MG/L)



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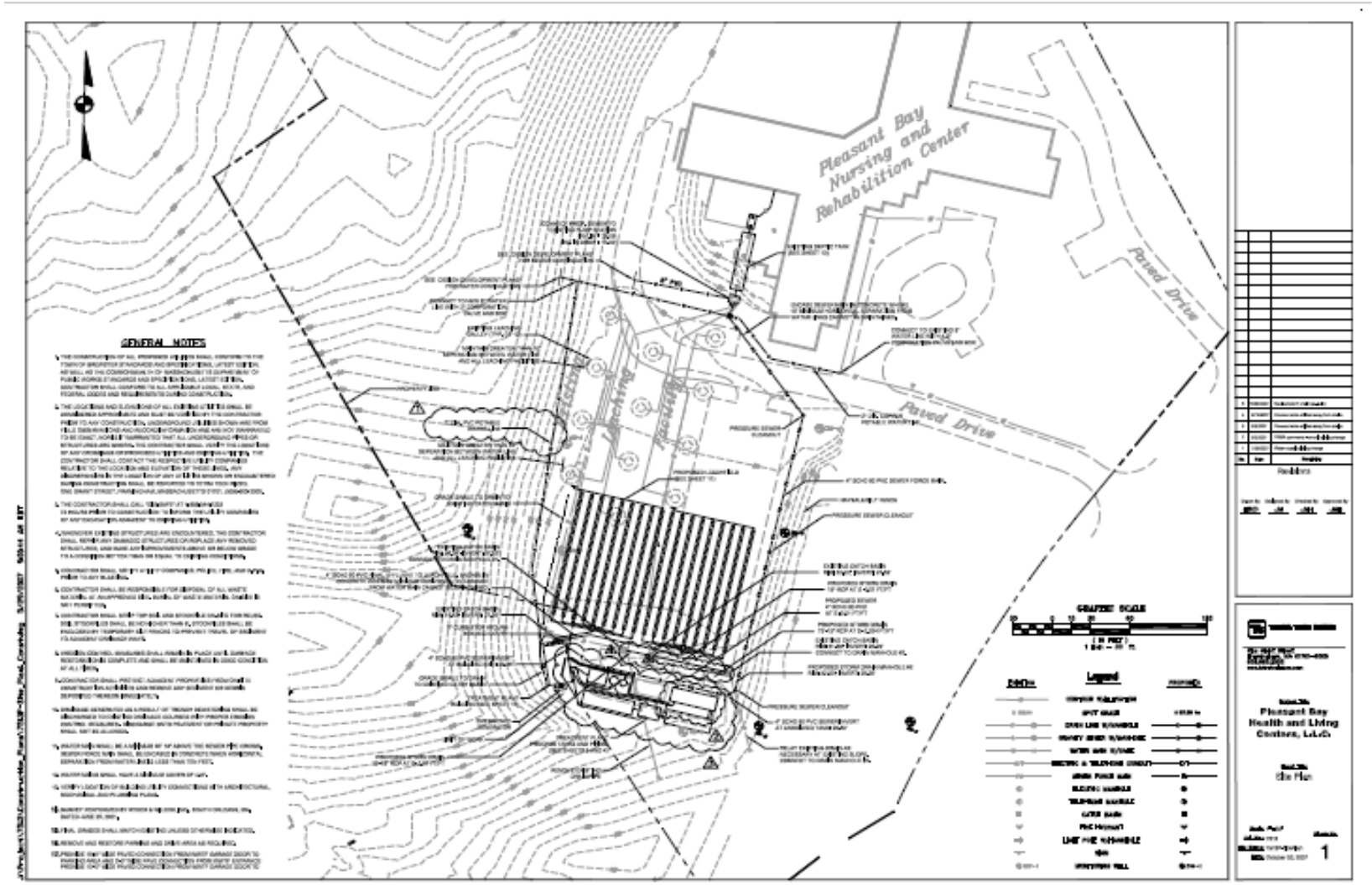
MapsOnline by PeopleGIS

PLEASANT BAY NURSING/WOODLANDS



BENEFITS OF DECENTRALIZED TREATMENT

- Cost-Effectiveness: Decentralized systems are often more economical than large centralized treatment plants and individual I/A systems. They avoid hefty capital costs relative and reduce operation and maintenance expenses with full accountability.
- Environmental Benefits: Superior treatment with flow equalization to avoid toxic shot loads. These systems protect the environment, public health, and water quality by providing reliable wastewater treatment performance in reducing conventional pollutants, nutrients, and emerging contaminants.
- Water Conservation: Decentralized treatment can facilitate local water reuse, contributing to water conservation efforts4.
- Flexibility and Scalability: Decentralized systems are flexible and can be adapted to various applications. They can be scaled up or down as needed.

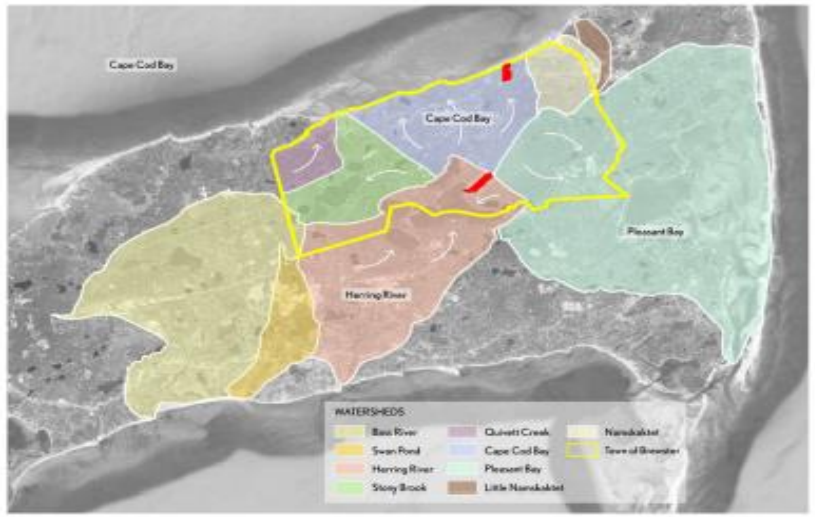
CONSIDERATIONS FOR SITING

- Need: Zone 2 wellhead protection “environmentally sensitive area” or within impaired watershed to surface water bodies “nutrient sensitive areas” or zoning restrictions on intensity of use; currently and in foreseeable future.
- Density: The benefit to cost is greater where there is high density housing, multi-family, commercial or institutional facilities with high flow per unit area. Less legal headaches if common ownership or entity.
- Alternatives: Many permitted WWTF facilities have additional capacity for wastewater treatment of offsite waste. Similarly, central sewering of abutting towns may allow for utilization of excess capacity or purchase of nitrogen credits.

OPPORTUNITIES

POND PROPERTY - WATER QUALITY AND WASTEWATER TREATMENT

Regional Watershed



- Introduction of a new wastewater treatment plant on the Pond Property would also improve overall Long Pond & Herring River water quality
- Brewster has an Integrated Water Resource Management Plan which addresses our long-term wastewater needs and plans across the entire community
- The primary focus in past decade has been on Pleasant Bay Watershed – Brewster shares a permit with Orleans, Harwich, and Chatham that includes certain nitrogen mitigation requirements over the next 20 years
- MA Dept of Environmental Protection issued changes to Title V regulations and implemented new Nitrogen Sensitive Watershed regulations in July 2023 that impact wastewater planning across the Cape
- The Pond Property falls within the Herring River Watershed – stormwater runoff from the property flows to Long Pond and eventually to the Herring River in Harwich
- Brewster plans to develop a Herring River Watershed Permit by 2030 and expects any new development in this area will require 100% nitrogen offset
- The Pond Property is uniquely situated to potentially locate a small wastewater treatment plant that could accommodate new housing buildout and replace traditional septic systems in some adjacent neighborhoods

Text credit: Town of Brewster Integrated Water Resource Management Plan, Horsley Witten Group

RESOURCES/REFERENCES

- EPA's Decentralized Wastewater Partnership https://www.epa.gov/septic/epas-decentralized-wastewater-partnership
- Integrated Wastewater Management Plan (2022 Update) https://horsleywitten.com/brewsterIWRMP/reports/2022IWRMPUpdateFinal_Jan27.pdf
- Pleasant Bay Management Alternatives Analysis (Final Report 2015) https://horsleywitten.com/brewsterIWRMP/reports/PhaseIII/150323_AlternativesReport_FINAL.pdf
- Cape Cod Sea Camps Community Forum #4 (February 2024) https://www.brewster-ma.gov/sites/g/files/vyhlif6286/f/uploads/240215_community_forum_4_final_small.pdf
- MassTC: Wastewater Testing Center Technology Summaries https://www.masstc.org/technologies

QUESTIONS